Learning Resources

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Learning Resources

COSEE California

Halversen, C, K. Beals, & L. Barakos (2009). *Communicating Ocean Sciences Instructor's Guide.* Berkeley, CA: Regents of the University of California, Berkeley.

The Communicating Ocean Sciences (COS) course introduces undergraduate and graduate students in ocean science related majors to inquiry-based instructional strategies for communicating their passion for their subject area. COS has created and nurtured partnerships between university scientists and K-12 educators across the COSEE Network and beyond, and provides college students with K-12 ocean sciences teaching experiences, which in turn benefit thousands of students around the country. Universities gain an efficient and effective mechanism for providing educational outreach to their local communities and for conducting and improving the effectiveness of their subsequent broader impact activities. These efforts are being sustained by the strong project partnerships that have formed, and new projects are continually being catalyzed as a direct result of COS, including a network to share resources and provide regional professional development for scientists and informal science educators.

Halversen, C. & Tran, L. (2009). Communicating Ocean Sciences to Informal Audiences Instructor's Guide. Berkeley, CA: Regents of the University of California, Berkeley.

The Communicating Ocean Sciences to Informal Audiences (COSIA) course leverages the success of COS and broadens COSEE's reach by partnering scientists with informal science educators, offering informal science education institutions low/no cost programs provided by enthusiastic and diverse college students, and providing college students with informal ocean sciences teaching experiences that in turn benefit thousands of students and families with children.

Tran, L. & Halversen, C. (2009). Reflecting on Practice: A professional development program for informal science educators. Version 1. Berkeley, CA: Regents of the University of California, Berkeley.

This course leverages COSEE funds by providing another iteration of the COS course to reach a broader, more varied audience nationwide, as well as increases the quality and quantity of ocean sciences taught in informal settings.

Halversen, C., K. Beals, & E. Weiss. (2010). Ocean Sciences Sequence for Grades 3-5 Teacher's Guide. Regents of the University of California, Berkeley, in press. Published by Carolina Biological, Burlington, NC.

This curriculum sequence for grades 3-5 was developed through a collaboration between educators, curriculum developers, and ocean scientists and based on the COSEE-developed Ocean Literacy Essential Principles and Fundamental Concepts Scope and Sequence for grades

K-12, with the resulting curriculum sequence increasing the ocean literacy of grade 3-5 students and teachers engaging with it.

Halversen, C., K. Beals, & E. Weiss. (2010). Ocean Sciences Sequence for Grades 6-8 Teacher's Guide. Regents of the University of California, Berkeley, in progress. Published by Carolina Biological, Burlington, NC.

This curriculum sequence for grades 6-8 is being developed through a collaboration between educators, curriculum developers, and ocean scientists and based on the COSEE-developed Ocean Literacy Essential Principles and Fundamental Concepts Scope and Sequence for grades K-12, with the resulting curriculum sequence increasing the ocean literacy of grade 6-8 students and teachers engaging with it.

Halversen, C., K. Beals, M. Goss (2010). Aquatic Ecosystems Teachers Guide: An Integrated Science and Literacy Unit, Regents of the University of California, Berkeley. Published by Delta Education.

The Aquatic Ecosystems unit was developed in collaboration with several scientists as part of their broader impacts and is available through a national educational publishing house.

Halversen, C. (2007). Shoreline Science Teacher's Guide: An Integrated Science and Literacy Unit, Regents of the University of California, Berkeley, Published by Delta Education.

The Shoreline Science unit was developed in collaboration with Dr. Gary Griggs, director of Long Marine Laboratory, as part of his broader impact and is available through a national educational publishing house, which will increase the use of high quality ocean sciences curriculum.

Weiss, E. Beach Science from AfterSchool KidzScience. (2010). Regents of the University of California, Berkelely, in press. Published by Developmental Studies Center, Oakland, CA.

This after school curriculum was developed based on the Ocean Literacy Essential Principles and Fundamental Concepts Scope and Sequence for grades K-12 and will reach a broader audience by targeting a previously underserved population of out-of-school activity providers.

Skene, J. Index of Interactive Science Presentations. (2010). Regents of the University of California, Berkeley, in progress.

These ocean sciences content presentations will model for scientists how content may be introduced in an interactive fashion by integrating discussions, demonstrations, and PowerPoint presentations. The presentations illustrate the pedagogical strategies presented in the course so that scientists may apply them to the science courses that they already teach.

Science and Math Informal Learning Educators (SMILE) Pathway. http://www.howtosmile.org/

SMILE is an online database of high quality educational materials designed especially for those who teach school-aged children in non-classroom settings; inclusion of COSIA activities, based on the Ocean Literacy Principles and Fundamental Concepts, on the SMILE Pathway provides a mechanism for many more informal science education institutions and educators to access them.

EarthGuide Online Classroom. http://earthguide.ucsd.edu/eoc/

EarthGuide Online Classroom is a repository for materials and educational resources for teachers, students and parents. The website is being designed to strike a balance between the significance of science content, the effectiveness in enhancing teaching and student learning, general appeal of the presentation, accessibility, and ease-of-use.

Deep Sea Extreme Environment Pilot (DEEP) – XBOX 360 Prototype Games. http://www.youtube.com/watch?v=EAtt067MbJE

These games can potentially serve as integral components of problem-based learning activities, and be structured to promote higher-order thinking skills in an entertaining context. The prototype games are being designed and tested for use in informal learning environments, and include exploration of a deep sea hydrothermal vent and manipulation of equipment at an ocean observatory.

Perspectives on Ocean Sciences Speaker Series http://www.ucsd.tv/oceanscience/
Researchers in fields such as climate science, seismology, medicines from the sea, and marine biodiversity, among many others, provide the public with direct access to up-to-date science in a presentation that is specifically designed for a lay audience. This series is co-sponsored by COSEE CA and the Birch Aquarium at Scripps. The series as a whole has had over 3 million views from the UCSD- and UC-TV websites and has reached a broadcast audience of over 15 million households.

POLYPPS

Pacific Ocean Literacy for Youth, Publics, Professionals and Scientists (POLYPPS) is a collaboration between COSEE California and the University of Hawaii. POLYPPS stems from the premise that science education must draw not only from the latest advances in western science and technology but also from the cultural contexts in which learners are embedded. The project focuses on training educators and scientists to effectively communicate ocean sciences to public audiences that include multi-ethnic populations expressing a range of cultural contexts.

Duncan Seraphin, K. and Lemus, J. (2009). Communicating Ocean Sciences: Traditional Knowledge Course Modifications. University of Hawaii at Manoa. Graduate seminar in Ocean and Engineering Science and Technology.

This course utilized the framework of the UC Berkeley COS course and integrated elements of traditional ways of knowing and indigenous knowledge systems into discussions and activities to create a more culture- and place-based focus to the syllabus.

Brown, D. and Coopersmith, A. (2010). Communicating Ocean Sciences Course: Traditional Knowledge Course Modifications. UH Maui College. Undergraduate course in Natural Sciences.

This version of the COS course was similarly modified to integrate traditional knowledge, but was geared toward undergraduate students with a background in marine sciences.

Lemus, J. and Coopersmith, A. (2010). Bachelor of Applied Science Degree Program in Applied Ocean Studies. UH Maui College.

Initiated as a result of the closer COSEE-based collaboration between the UH Manoa and UH Maui College campuses, a new degree program was proposed by Maui College to serve local students interested in ocean science related careers such as teaching, management, and conservation. The curriculum is a complete upper division program of study that includes sixteen core and elective courses.

COSEE West

General Resources

Formal educator resources (2002-2010):
http://www.usc.edu/org/cosee-west/resources.html

COSEE West resources for scientists (2002-2010):
http://www.usc.edu/org/cosee-west/forscientists.html

COSEE West resources for informal educators (2002-2010):
http://www.usc.edu/org/cosee-west/forinformalscienceeducators.html

Resources from COSEE West's partnership with the Los Angeles Charter School Science Partnership (LACSSP), an initiative of the California Math Science Partnership (CaMSP) of the California Department of Education (2010-2011):
http://www.usc.edu/org/cosee-west/camsp.html

COSEE West staff distributes existing curricular and support material, and creates new lesson plans relevant to the content and concepts presented at COSEE West lectures and workshops. Participating educators are given these materials at each COSEE West lecture and workshop, and can conduct selected activities before presenting them in their classrooms.

Curricula

COSEE West teacher-developed ocean sciences curricula (2002-2010):
http://www.usc.edu/org/cosee-west/curricula.html

Bearzi, Maddalena and Sitkoff, Seymour, 2004. Project Cold curricula.

Project Cold, an instruction module based on the polar regions, provides science content and inquiry-based activities for grades 4-8. Originally created by LAUSD science staff, Project Cold is being revised and expanded by COSEE West scientists and will be field-tested by participant teachers and their students. Project Cold is available on the COSEE West website.

Ozuna, Ronald, 2005. Marine Science Emphasis Inquiry Lessons.

Ocean-themed lessons that illustrate concepts addressed by 6th grade Science Content Standards in Physical Science, Life Science, and Ecology to be used by 6th grade teachers in preparing students for Periodic Assessment testing. Ron Ozuna, the LAUSD high school teacher who created the lessons, was released from school duties 50% time to be a Teacher Advisor to COSEE West. He trained interested 6th grade teachers to use these lessons in Professional Development workshops during his release time. These lessons are available on the COSEE West website.

Ozuna, Ronald, 2005. 9th Grade Integrated Coordinated Science (ICS) Course using ocean sciences as an integrative theme.

The LAUSD course consists of modules in Earth Science, Chemistry, Biology, and Physics that use marine science and inquiry to engage the students' curiosity. The course was field tested and revised by Ron Ozuna, who created the course and who was released by LAUSD 50% time to act as a Teacher Advisor for COSEE West. Elements of the course were presented in year 4 COSEE West workshops. The course is available on the COSEE West website for download.

Perry, Robert, 2005. OceanGLOBE.
http://www.usc.edu/org/cosee-west/curricula.html#oceanglobe

Identification guides, protocol, curricula, and PowerPoint presentations developed for grades 9-12 from the OceanGLOBE program.

Santa Monica Bay Observatory Teachers' Portal (2006-2008):
http://quercus.igpp.ucla.edu/smbo/smbo_edu_teacher.html

Ocean observatory lesson plans, data, and buoy information

Steinmetz, Brigitte and Holland, Kurt, 2005. OceanGLOBE.
http://www.usc.edu/org/cosee-west/curricula.html#oceanglobe

Identification guides, protocol, curricula, and PowerPoint presentations adapted for grades 5-8.

USC Island Explorer Parent Child Education Program
http://www.usc.edu/org/seagrant/Education/ParentChildEdu/ParentChildEd.html

A course for parent-child teams in marine and environmental science that focuses on the urban-ocean connection.

USC Sea Grant Island Explorers and Parent Child Education Program, 2005.
http://www.usc.edu/org/seagrant/MSEdu.html

The website provides a free 4th-5th grade marine science curriculum for teachers. The parent-child program uses the curriculum as a basis to teach marine science to parent-child teams in a 7-week program. We hope to expand this program to higher grade levels through COSEE West.

<u>Ocean Science Tools and Resources</u>

COSEE-West and LAUSD, 2005. Oceanography Bibliography: Interrelating Language and Science, K-12.
http://www.usc.edu/org/cosee-west/oceanbibliog.html

KLCS TV video, 2005. Teachers' Corner program, Under the Sea and Into the Classroom.

Features the COSEE West program. LAUSD teachers can access this video free of charge through syndicated programming on KLCS.

Ozuna, Ronald, 2007. Marine Science Video List.
http://www.usc.edu/org/cosee-west/PDFs/MarineVideoList_1106.pdf

A list of commercial videos on ocean sciences topics appropriate for use in K-12 education.

Sitkoff, Seymour, 2003. Ocean Literacy: Essential Principles of Ocean Sciences Related to the California Science Education Standards.
http://www.usc.edu/org/cosee-west/PDFs/OCEAN_LIT_chartCalif.pdf

Sitkoff, Seymour, 2003. Ocean Literacy: Essential Principles of Ocean Sciences Related to the National Science Standards.
http://www.usc.edu/org/cosee-west/PDFs/OCEAN_LIT_chartNatl.pdf

COSEE West participated in the original development of the Ocean Literacy Essential Principles and Fundamental Concepts (OLEPFC) and attended/hosted meetings to develop a Scope and Sequence to help educators implement the OLEPFC in an age and topic-appropriate manner.

Sitkoff, Seymour, 2004. Correlation of the National Science Education Standards with the K-12 California Mathematics and English/Language Arts Content Standards.

Workbook linking Math and English Language/Literacy standards to Science standards.

Sitkoff, Seymour, 2005. History/Social Studies – Science Content Standards Workbook.

Workbook linking History/Social Studies content standards to Science content standards.

Sitkoff, Seymour, 2006. The Open Court Reading Program and Related Integrative Ocean Sciences Activities.

This handbook includes ocean-themed literature and inquiry-based ocean sciences activities to be used with the Open Court curriculum required in many LAUSD elementary schools.

Sitkoff, Seymour and Adler, Gayle, 2007. Marine Science Field Trip Guide for Teachers.

Handbook correlating the California science standards with the state adopted instructional materials published by Harcourt Brace and LAUSD approved FOSS science kits for grades 4-5.
http://www.usc.edu/org/coseewest/PDFs/FIELDTRIPS_OCEAN_SCI_rev11_07a.pdf

USC Division of Animation and Digital Arts (2005-2006). Ocean Tube.
http://www.usc.edu/org/cosee-west/ocean_tube.html
Animations about ocean sciences concepts and current research by USC ocean scientists.

COSEE Central Gulf of Mexico

Online Lessons and Scientists PowerPoint Presentations:
Seventy-nine lesson plans have been developed and/or revised during 2006-2009, encompassing the 2003-2009 timeframe. These lesson plans are located on www.cosee-central-gom.org and are also linked to the Bridge (electronic library or formal and informal educators, housed at the VA Institute for Marine Science).

These lesson plans are aligned with the Ocean Literacy Essential Principles and Fundamental Concepts (OLES & FC) and the National Science Education Standards (NSES) and linked to the five Gulf of Mexico States' Standards. The majority of scientists' online PowerPoint presentations may also be found on the COSEE CGOM website.

COSEE Florida (2002)

Books

Alexander, L, Desonie, D, Kelchner, C, Lambert, J., Leaney, L, Menzel, T., Shreeves, K., Watts,J., Wohlers, B. & Wolfe, G. (2010, 2006). *Life on an ocean planet*. Rancho Santa Margarta,CA: Current Publishing Corp. Adopted in Florida, Alabama, Georgia, and several U.S.and Australian school districts for marine science courses.

Alexander, L., Lambert, J., Mafia, B., Menzel, T., Sakai, A., Monika, S., Shreeves, K, Mafia, C., Tohulka, M, & Wohlers, B. (2010, 2006). *Life on an ocean planet teacher curriculum guide*. Rancho Santa Margarta, CA: Current Publishing Corp.

Courses

Development of Course at Florida Atlantic University (Julie Lambert)

EDG 5931 Special Topics Course: Methods for Teaching Ocean Science. Teacher Education. Developed and piloted a new course in science education (Fall 2006).

Syllabi and curricular materials were developed for nine graduate courses related to ocean sciences at USF (Barbara Spector).

Four courses comprising the *Informal Science Institutions Environmental Education Graduate Certificate Program* were prepared for distance learning via the web. (The title of the program was shortened when it went through the University institutionalizing process) They are
(1) Methods for Interpretive and Transformative Standards Based Education
(2) Community resources for Environmental Education
(3) Environmental Site Explorations
(4) Survey Update of Environmental Research and Management Policies

The additional courses were a sequence identified by numbers. The titles were *Ocean Science Community Building I-III, Seminar on Ocean Science Education,* and *Ocean Science Education Policy, Change, and School Improvement.*

Additionally, two extensive syllabi providing introductions to issues in marine science intended for use in a Master's of Arts in Science Teaching were developed.

The Ocean Science Concept-driven Interactive Teaching Model FAMU (Jennifer Cherrier)

Title: Incorporation and review of new science content and inclusive pedagogical strategies into the post-secondary Ocean Science Concept-driven Interactive (OSCI) teaching model.
Type: Development, review, and digitization of a post-secondary ocean science teaching model i.e., a concept-driven interactive ocean science teaching model.

Target Audience: Ocean science instructors at post-secondary institutions and those students whom they teach.
Duration/Date: January 2005-January 2006.
Website: http://www.famu.edu/acad/colleges/esi/OSCI/
Description of Activity:
The OSCI teaching model has been designed for a typical post-secondary 16-week semester class period and setting (i.e. small classroom of 20-40 students or large lecture hall of 100-150 students). This model blends both traditional lecture-based and concept-driven/interactive methodologies through the integration of mini-lectures, readings, writing, and focused group discussions. At the end of the summer 2004 through our initial survey we had identified a subset of 20 Florida science advisors who had indicated that they would consider reviewing the OSCI model for content accuracy and pedagogical strategies. We further broke this subset of 20 scientists into their respective ocean science disciplines (i.e. geological, physical, chemical, and biological) and assigned them sections of the teaching model to review for science content accuracy, relevance, and pedagogical strategies.

A letter was then sent to each of these potential science advisors as well as a guide to assist them with the review. By January 2005 received reviews from nine of these science advisors: David Enfield, NOAA/AOML; Thorsten Dittmar, FSU; Junda Lin, FIT; Klaus J. Meyer-Arendt, UWF; Gabriel Vargo, USF; William Dewar, FSU; Cathy Bester, UF; Lia Chasar, FAMU; and Jennifer Beauregard, TCC. Their overall ratings of those sections of the model that they reviewed ranged from very good to excellent. Where they deemed necessary each reviewer provided detailed input with respect to suggested corrections/modifications to their assigned content areas.
J. Cherrier completed the revisions to the model by January 2006 and the revised OSCI teaching model has been sent to each of the reviewers for implementation at their respective institutions and/or to share with their colleagues. The ultimate goal of our work on the OSCI teaching model has been to make this teaching 'tool' available to all interested instructors at post-secondary institutions to aid with a transition from a traditional approach for teaching the ocean sciences to one that is more concept-driven, collaborative and interactive. To this end the FAMU team has now completely digitized the OSCI teaching model. The OSCI model is now presented on a CD-ROM in a user friendly PC and Macintosh compatible platform such that an instructor in any type of post-secondary institutional setting should be able to easily adopt the OSCI model either in part or in its entirety.

Finally, because of the many facets of the OSCI teaching model it is difficult to effectively upload the model in its entirety onto a website or portal (individual lectures maybe but not the entire model). The FAMU team has therefore developed an OSCI website (http://www.famu.edu/acad/colleges/esi/OSCI/) to provide an overview of the OSCI model as well as to introduce the various components of the teaching model to those who might be interested in adopting it in their classrooms.␣ Intended Outcome␣ Dissemination of the digitized OSCI teaching model to as many interested post-secondary instructors as possible for implementation at their respective institutions.

Participants Information
Scientists:
Nine scientists were involved in the review process. Sources of Funding: NSF, NOAA, USGS, NASA, ONR DFG, ACS. Informal Educators:
Potentially the teaching model will impact hundreds of students.
Diverse Population: African Americans (FAMU, DSU, MSU, JSU), Hispanics (UM)
Evaluation:
All of the instructors who use the OSCI teaching model are asked to complete an evaluation survey for the OSCI model and are encouraged to have their students complete an online use the 'Student Assessment of Learning Gains' (SALG) instrument (web address http://www.wcer.wise.edu/salgains/instructor/default.asp)

Teacher Education Materials

Spector, B. (200*7), SEACOOS Case Study Template for Science Teacher Education* (co-producer Dave Bethany)

The intent of this grant funded multi media product is to demonstrate how SEACOOS science can be used by science teacher educators and staff developers to accomplish a variety of goals in science teacher education. This template package provides guidance to develop case studies of ocean observing scientists .

Leard, C. ***SEACOOS Summer Physical Science Workshop "How To" Manual***

This document enables others to replicate the *Boats, Buoys, and Science Teachers: A Winning Combination.*

Week-long workshop at USF

The template package consists of (a) a protocol with which to interview an ocean observing scientist or engineer, (b) options for ways to use the interview once recorded, (c) eight sample video interviews (270 minutes) on DVDs, (d) five written case studies derived from video cases, and (e) a narrative for use with teachers across the U. S. describing the context for seven interviews conducted by a college and a high school student. The distribution vehicle for this template package is the SEACOOS website.

Curricular materials were developed for educating teachers to accompany the exhibit, ***Coastal Ocean Monitoring and Prediction Sensor*** at the Campbell Park Elementary Marine Science Center.

Curricular activities were developed to accompany the posters, ***Forming Hurricanes*** **and** ***Ocean Currents*** developed in partnership with SEACOOS. They were disseminated through the web.

Coastal Ocean Observing Systems: Real Science That Affects You. This DVD is a tool for teachers and other audiences. It emphasizes sensors on buoys.

COSEE SouthEast

***Guide to Marine Debris: Southeast and Gulf of Mexico,* (2009). Book, target audience: middle School. Published print and online Editor(s): L. Spence, 44 pages. COSEE SE Sea Grant Consortium, Charleston, SC web: www.cosee-se.org.**

This is a collaborative project coordinated by COSEE SE that engaged NC, SC, GA, FL, MS, Al, and LA with multiple sources of funding. It provides information about four types of marine debris, lessons, and resources and relevance to each of the partner. .

***Our Amazing Coast* (2009) Elementary School, Online Editors: Olsen, M., Vernon, E., Livingston, C, Jolly Clair, J., Kirby Hathaway, T., Bliss, A. (online) www.cosee-se.org.**

Our Amazing Coast consists of a CD of lessons and resources provided to teachers in NC, SC and GA who participated in a series of pilot PD workshops that are in the process of being edited for online access. Other elementary lessons based on the publication by Georgia Sea Grant, Georgia's Amazing Coast are available on the Georgia Sea Grant website.

***SeaSeekers* (2008-09) Middle School, Online Editors: Joyner, E., Spence, L., Leaphart, L., Bliss, A. Series of seven lessons and five investigations focused on estuaries. online: www.cosee-se.org.**

These are 12 middle school lessons and research investigations developed with the NSF OEDG award with South Carolina State University that have been tested at the SCSU Felton Lab School. Final versions continue to be edited and placed on the web.

***SouthEast Atlantic Coastal Ocean Observing Lessons: Hurricanes, Waves, Currents, Circulation.* Online, middle to high school level. Online: www.secoora.org/classroom**

These are a series of lessons and resources that supported four thematic posters developed with the ocean observing research community by COSEE SE and COSEE Florida. Lessons were developed and field tested. Resources were identified. Results presented in national and regional conferences.

COSEE New England

Ocean science curriculum lessons and units, designed by educators and scientists, were piloted in middle and high school classrooms. Some examples include: one unit on *Mud Snails* was adopted as a FOSS replacement for their middle school ecosystems module by the Boston Public Schools Science Department; in Plymouth Public Schools, an ocean sciences curriculum was developed for 7th grade students; in Fairhaven Public Schools, a team of science teachers developed a vertically aligned unit on the carbon cycle for middle and high school students.

A Telling Your Story handbook is posted on the COSEE NE website for others to conduct TYS workshops.

COSEE Ocean Learning Communities

Tzou, C, Bruner, A., Clay, T., & Scalone, G. (2009). My place in Puget Sound: Making connections between people, places, and marine environments. Seattle, WA: Center for Ocean Sciences Education Excellence-Ocean Learning Communities, University of Washington.

This is a curriculum design project that is a collaboration between learning scientists, ocean scientists, the Sound Citizen project and OACIS-GK12 teachers to design curriculum that takes advantage of the local, community-based knowledge of students in ocean sciences education.

COSEE Great Lakes

Published on CD [to be online in 2011]

Greatest of the Great Lakes: A Medley of Model Lessons.

Selected existing classroom activities on topics of Great Lakes Overview, Life in the Water, Habitats, Climate & Weather, Hydrology, Coastal Processes, and Issues constitute the 41-lesson collection. Selections meet teachers' needs for classroom utility, quality, and topic coverage.

Published online

Fresh and Salt: A Curriculum Integrating Ocean and Great Lakes Literacy Principles

COSEE Great Lakes has a goal of enhancing marine education in Great Lakes classrooms, and at the same time bringing the inspiration and vital contributions of the Great Lakes to marine education nationally. A complement to Greatest of the Great Lakes, this 14-lesson set includes two for each Ocean Literacy and Great Lakes Literacy Principle. It will be distributed online to all COSEEs, through teacher trainings at state, regional, and national education conferences, and to the public. Access at http://www.iiseagrant.org/education/freshandsalt.html

Teaching with Great Lakes Data

Free online curriculum provides educators and students data collected in the Great Lakes and breaks the information into a digestible format. Greatlakeslessons.com provides Great Lakes data sets, an overview of teaching methods, and ready-to-go lessons and activities.

Published in juried education journals [also listed in COSEE GL_Publications]

Fortner, Rosanne W. & Deborah B. Jenkins, 2009. Simulated sampling of estuary plankton, Science Activities 46(1): 26-32.

Article is an adaptation of one of the Greatest of the Great Lakes lessons and helps COSEE reach audiences beyond the GL region.

Fortner, Rosanne W., Autumn 2009. Executive Editor, Special Issue on Ocean Literacy, Science Activities 46(3).

This is part of the Network contribution of COSEE GL. Fortner solicited lesson plans to match each of the Ocean Literacy Essential Principles, and worked with authors to meet Science Activities formats. Five activity authors in the issue are research scientists or GK12 Graduate Fellows. Authors represent four COSEEs and two NOAA programs. Three additional ocean literacy lessons appear in the subsequent issue of Science Activities [Winter 2010], so that all the quality materials could reach the SA audience of teachers.

Fortner, Rosanne W., and Victor J. Mayer, 2009. How is coastal temperature influenced by the Great Lakes and ocean? Science Activities 46(3): 20-26.

This lesson was part of the Ocean Literacy issue of Science Activities and is also part of the Fresh and Salt collection for COSEE GL. Network function.

Parsons, C., S. Stewart, R.W. Fortner and S. Lichtenwalner, COSEE and Ocean Observing Systems: The Wave of the Future. *Current, The Journal of Marine Education* 23(1): 26-28.

Part of the COSEE special issue of Current, a product of the COSEE Network

Fortner, R.W., 2007. COSEE Great Lakes. *Current, The Journal of Marine Education* 23(1): 37.

Program one-pager, part of the COSEE special issue of Current. Network function.

Fortner, R.W., Marcia Swan, and Bruce Munson. 2007. Introducing the Great Lakes: Fourth Coast of the U.S. *Connect* 20(5): 7-9.
This invited article uses one of the Greatest of the Great Lakes lessons from COSEE GL. Connect is a journal by and for educators, produced by Synergy Learning. Reaches audiences beyond the region with information about the ocean-like characteristics of the Great Lakes.

COSEE Ocean Systems

Online

deCharon, A., S. Graham, J. Albright, C. Companion, C. Herren & M. Steinman, (2010). Concept Linked Integrated Media Builder (CLIMB), http://cosee.umaine.edu/tools

The Concept Linked Integrated Media Builder (CLIMB) is a suite of web-based, ocean-climate multimedia learning tools. It consists of the Ocean-Climate Interactive (OCI) and the Concept Map Builder (CMB). It is intended to "map" ocean topics into the educational standards, and bring the relevance of the oceans to classrooms, particularly rural and inland audiences. It is designed to aid learners in better understanding the context of the oceans in both the earth and solar systems.

deCharon, A., S. Graham, J. Albright, C. Companion, C. Herren & M. Steinman, (2010). Ocean Climate Interactive (OCI), http://cosee.umaine.edu/cfuser

The Ocean Climate Interactive (OCI) is a flash-based application that allows users to explore the interrelationships of ocean climate concepts. It facilitates and enhances subject comprehension by providing a framework for integrating marine topics with other subject areas. Educators can use the OCI in their classrooms as an easy-to-access resource for engaging material; students can browse the concepts and their assets to learn more about them in a way that invites further exploration. The Earth-Sun System View, Earth View, and Close-Up View interfaces showcase various concepts, each of which is linked to other concepts, subconcepts, and a multitude of assets. There are four types of assets: news items, images, videos and animations, and learning resources (e.g., a lesson plan, an interactive flash application, a web-based learning module).

deCharon, A., S. Graham, J. Albright, C. Companion, C. Herren & M. Steinman, (2010). Collections of Concept Maps that Align with Ocean and/or Climate Literacy Principles, http://cosee.umaine.edu/resources/

For each COSEE OS "Scientist-Educator Collaborative Workshop" and "Graduate-Faculty Collaborative Workshop" a set of Ocean and Climate Literacy Principles are used for pre- and post-workshop assessment. Prior to a workshop, participants rated their comfort with specific Principles, along with relevance to their teaching or research situations. After the workshop, all educators' pre-workshop ratings were compared with their post-workshop data to quantify their change in comfort with and their perceived relevance of the Principles. These ratings, along with copies of the concept maps developed in each these workshops, are available online.

Karp-Boss, L., E. Boss & H. Weller, (2008). Teaching Physical Sciences by Ocean Inquiry (SMS 491 and EDW 472) Syllabus, http://misclab.umeoce.maine.edu/boss/classes/SMS_491_2008/SMS_491_2008_index.htm

Two University of Maine undergraduate courses were taught in Spring 2007 and Spring 2008, targeting Marine Sciences and Education majors. Instructors utilized an inquiry-based instructional approach to learn about physical sciences content and relevant ocean examples that could be used to illustrate them. The science content was balanced with relevant pedagogical strategies that are commonly used to teach science concepts. One session per week focused on the scientific content using cooperative learning groups and hands-on lab activities. The other weekly session used a roundtable format in the discussion of pedagogical strategies that are relevant or effective in teaching the previous class's science concepts. Students were encouraged to reflect on their class experience in journals that were periodically reviewed by the instructors. The structure of the course was designed to enable the students to reinforce their content knowledge, organize it, decide on key concepts, and then enlist the methods they could use to teach that content. The students were also invited to discuss the social, cultural, and political dimensions of bridging the gap between science and education.

Hardcopy & Online

Karp-Boss, L., E. Boss, H. Weller, J. Loftin & J. Albright, (2009). Teaching Physical Concepts in Oceanography: an Inquiry Based Approach. *Oceanography* Suppl., 22(3), 1-52.

The publication is available in English (hardcopy & online), Spanish, Catalan, and French (online only) at http://tos.org/hands-on/teaching_phys.html. This 52-page supplement to Oceanography Magazine focuses on educational approaches to help engage students in learning and offers a collection of hands-on/minds-on activities for teaching physical concepts that are fundamental in oceanography. These key concepts include density, pressure, buoyancy, heat and temperature, and gravity waves.

COSEE Alaska

Bering Sea Collection of Lesson Plans and Activities

In October, 2010, COSEE Alaska partnered with the North Pacific Research Board, the Arctic Research Consortium of the United States (ARCUS) with funding from National Science Foundation Office of Polar Programs, NOAA Teachers at Sea, and Monterey Bay Aquarium Research Institute to provide a teacher-scientist workshop, bringing back together teachers who went to sea with field scientists with project scientists. The product of the research is the Bering Sea Collection of lesson plans and activities developed by the teachers with assistance from scientists, and resources (data sets, websites, video, etc) that will become part of a Learning Resources Database (http://www.polartrec.com/resources). A special page will be created just for these resources to be linked by COSEE Alaska and NPRB websites.

The 28 participants (either in person or remotely) included 11 teachers, 11 researchers, and six supporting staff, including Dr. George Matsumoto, as the workshop facilitator, and the COSEE Alaska evaluator, Andrea Anderson. The agenda was structured around the hypotheses and focal areas of the Bering Ecosystem Study – Bering Ecosystem Integrated Research Project (BEST-BSIERP) as essential questions for K-12 curriculum. Several of the teachers had had researcher experiences on the Bering Sea project. Researchers presented new content, which was used by the teachers to create new lessons and help build the collection of educational resources.

Alaska Sea Grant *Alaska Seas and Rivers* Curriculum

In 2009, COSEE Alaska adopted the recently developed Alaska Seas and Rivers online curriculum as its primary K-8 curriculum resource along with its "best practices" as criteria for review of other curriculum resources for inclusion as K-12 educational resources on ocean climate change on the COSEE Alaska website. These practices included alignment of the units with both national Ocean Literacy Principles and Alaska grade-level standards for science education, an inquiry and learning cycle approach, and authentic assessment methods.

COSEE Alaska partnered with Alaska Sea Grant and other organizations and natural resource agencies to develop a curriculum for half-day and full-day on-site teacher professional development workshops to disseminate the curriculum and included ocean climate change content and information on COSEE Alaska resources for teachers. Workshops were held for more than 250 teachers in four school districts in South central and Western Alaska (Bering Straits, Southwest Region, Copper River, Chugach) in August and September 2009. In October 2009, and again in September 2010, COSEE Alaska and Alaska Sea Grant partnered with the UAF Cooperative Extension Service and the U.S. Fish and Wildlife Service to expand an annual professional development workshop for approximately 20 rural Alaska teachers focused on a classroom salmon incubation project to include a focus on the ocean phase of the salmon life cycle and the potential effects of climate change on the ocean and watersheds. COSEE Alaska Program Manager Marilyn Sigman provided resources and instruction at the workshop in both 2009 and 2010 and arranged for scientists to make presentations and interact with the teachers both years. In October 2010, similar content and resources were provided for 25 Kenai

Peninsula School District elementary teachers at a teacher-scientist workshop provided by COSEE Alaska's informal education partner, the Alaska SeaLife Center on the theme of water. COSEE Alaska Project Evaluator Andrea Anderson developed questions for pre- and post-workshop surveys of scientist participants for all three workshops.

WGBH Boston *Alaska Native Perspectives on Earth and Climate* Special Multi-media Collection and Lesson Plans

COSEE Alaska added science content and provided instruction at an "Indigenous and Western Science Observations on Climate Change: resources for teachers" summer institute for 7-12 science educators in Anchorage, Alaska, in May, 2009. Participants included 30 rural Alaska teachers whose students are predominantly Alaska Native, and 10 teachers from the Anchorage School District. Several Arctic geoscientists were also involved as presenters. COSEE Alaska PI Ray Barnhart and COSEE partner Texas Gail Raymond, Science Curriculum Coordinator for the Anchorage School District, were involved in the workshop through another NSF grant to feature the new online collection of multi-media videos and associated lesson plans. Dr. Barnhart made a presentation and shared resources for planning ocean science fairs, including an ocean science fair lesson plan in the special collection on the WGBH Boston Teacher's Domain website. COSEE Program Manager Marilyn Sigman presented and led hands-on activities related to Alaska ocean climate change and described COSEE Alaska resources for teachers. An evaluation of the COSEE Alaska sessions in the form of a short survey of participants found the session to be highly relevant to the teachers (89% of respondents rating the sessions a 4 or 5(high), a significant "take away" from the session was the recognition of the connection with tribal elders was a knowledgeable resource about changing climate; and the resources and connections were deeply appreciated.

Alaska Ocean Observing System Lesson Plans

COSEE Alaska partnered with the Prince William Sound Science Center to develop middle school lesson plans to teach ocean science concepts illustrated by the field experiment and employing Alaska ocean observing data. Drifters, gliders, and plankton blooms were used as engaging "hooks" for inquiry-based lessons. The lesson plans were piloted by PWSSC in schools in Cordova and Chenega, an Alaskan Native village. Lesson plans relevant to using drifters to track oil spill trajectories was developed into a DVD with podcasts and videos of the Prince William Sound Field Experiment and distributed at a session of the 2010 NMEA annual conference. The session focused on real-time data and oil spill related ocean observing activities developed by COSEEs and ocean observing regional associations. The lesson plans will be finalized following the completion of a re-design of the AOOS website to ensure accurate links to online real-time data.

Ocean & Climate Change Curriculum Framework

In 2009, the COSEE Alaska Program Manager convened and facilitated a workshop with an educator team from Alaska Sea Grant and the International Arctic Research Center (IARC) to review the gaps between the "essential principles of science" identified in the Ocean Literacy Principles and the Climate Change Literacy Principles and the Alaska state science standards.

The review showed that ocean science content was particularly lacking but climate change standards were included at the high school level. Accordingly, the team developed a curriculum framework, which correlated national ocean and climate literacy principles with Alaska state science standards and outlined an approach for teaching the relevant concepts with a focus on "big ideas" and topics relevant to the Alaska marine and polar environments. The approach incorporated the use of the concept mapping tool developed by COSEE Ocean Systems to promote and demonstrate strategies for the type of systems thinking that is requisite to understanding aspects of climate change and implications at regional and global scales.

Alaska Environmental Literacy Plan

In 2009, COSEE Alaska became a partner in the development of an Alaska Environmental Literacy Plan, which will be required for the State of Alaska to be eligible to apply for "Leave No Child Inside" funding in legislation pending in Congress. COSEE Program Manager, Marilyn Sigman serves on Steering Committee for the plan and the Standards and Correlations Committee. In 2010, her "gap analysis" for marine and climate change literacy was incorporated into the draft plan along with specific recommendations about changes to Alaska standards to improve this content consistent with age-appropriate scaffolding of concepts. The effort in Alaska is led by the Alaska Department of Education and Early Childhood Development, the Alaska Department of Fish and Game, and the Alaska Natural Resources and Outdoor Education Association, who are assembling a broad coalition of supporters from schools, communities, and the business sector.

Ocean Science Fairs

COSEE Alaska supports ocean science fairs in rural and coastal Alaska school districts. This signature program is based on a model developed by the Alaska Native Knowledge Network to address the need for culturally relevant science education for the many communities, which are predominantly Alaska Native and for other rural residents who are underserved by science education in general and underrepresented in ocean science careers. The ANKN model combined science fair judging criteria of scientific merit with criteria related to cultural and/or community relevance. COSEE Alaska revived the program with the support of COSEE PI Ray Barnhardt and program staffing which has shifted recently to graduate students in a new PhD program in Indigenous Studies at the University of Alaska Fairbanks. Formerly a general science fair, COSEE Alaska emphasizes ocean, watershed, and climate change topics; and provides support at local and regional school levels along with a "fair within a fair" at the Statewide Science and Engineering Fair, which doesn't require winning at the local or regional level.

COSEE Alaska initiated ocean science fairs with a statewide planning workshop with teachers held in Anchorage October 10-11, 2008. A second workshop for school district in western and northern Alaska was held in Anchorage on January 22, 2010.

The COSEE Alaska website information was developed in 2009 with links to ANKN resources for planning and conducting science fairs. In 2010, COSEE Alaska revised an existing manual on how to plan and host local science fairs and camps and science project ideas to focus on ocean science-themed fairs and projects and provide a list of more than 300 potential projects.

(http://www.coseealaska.net/files/alaska/COSEE%20Manual%20for%20Ocean%20Science%20Fairs,%20Science%20Projects,%20and%20Camps.pdf)
In 2009 and 2010, ocean science fairs were held in these school districts and communities:

- Unalaska City School District (Unalaska)
- Lower Yukon School District (Mountain Village)
- Bering Straits School District (White Mountain in 2009, Emmonak and Unalakleet in 2010)
- North Slope Borough School District (Barrow)
- Yukon Flats School District (Ft. Yukon in 2009 only)
- Southeast Alaska Science Fair/Juneau School District (Juneau)
- Kuspuk School District (Sleetmute)
- Kodiak Island Borough School District (Kodiak)

Financial support was provided by COSEE Alaska to cover the costs of one student and one teacher from each participating district to attend the Alaska State Science and Engineering Fair in Anchorage in March. In addition, the State Science Fair included the participation of some rural students through digital media and the Internet – cyber fairs – (using Skype), to offset the burden of travel costs. In 2010, more than 50 projects were judged at the statewide fair using the two types of criteria, a significant increase over 21 projects judged in 2009. COSEE Alaska gave out 15 cash awards to 18 individual students and student team members and an award that recognized the outstanding efforts of one teacher in 2010 compared to five cash awards to individual students in 2009.

Alaska Educator Needs Assessment for Ocean and Climate Change Education Resources

In 2010, COSEE Alaska partnered with IARC, the Anchorage School District, and the Alaska Science Teachers Association to conduct an online needs assessment survey of more than 500 than K-12 classroom teachers to discover how ocean and climate change topics were being addressed by educators and what needs exist for scientist education and outreach related to marine science and climate change education curriculum, resources and professional development. Results from the online survey (165 responses) showed that:

- Many Alaska teachers currently are teaching about climate change and the marine environment. The marine environment is addressed as a specific course or embedded in other units for more than half the teachers responding to the survey. In contrast only 2% identify climate change as a stand-alone course, while 30% say it is included in other content courses.

- When teaching about either topic, teachers use a variety of strategies—most frequently relying on classroom discussions about community concerns (54%) and curriculum connections (59%).

- Teachers invite guest speakers, including scientists and local elders, into the classroom to support their instruction on the topics. They use Alaska-specific lessons that align with state standards (61%), address critical issues (54%), and rely on "data" (46%) from research. Teachers also indicate a strong interest in having field trips with scientists to support their instruction.

- If teachers do not teach about marine environments or climate change, the typical reason given is that topics are not in the curriculum, and there is neither time nor resources to make it happen.

In 2010, COSEE Alaska also surveyed Alaska informal educators to assess their needs for professional development in marine and climate sciences. 44 informal educators with programs in 16 different communities responded to the survey and 40 indicated a need for professional development. Interest in opportunities for training in best practices for informal science education was expressed by 39 of the 40 respondents and for climate change education by all 40 respondents. When asked to rank 12 desired marine and climate science content topics, the most highly-ranked were: 1) climate science relevant to Alaska marine ecosystems; 2) marine and climate science related to global climate change; 3) how people learn; 4) climate change effects on Alaska ocean current patterns; 5) climate literacy; and 6) Arctic sea ice dynamics and feedbacks to global climate. When asked to rank 12 different possible topics, the most highly-ranked were: 1) outdoor or field-based design for learning; 2) pedagogy; 3) instructional strategies for diverse audiences; 4) citizen science/participatory research; 5) age-appropriate instructional strategies; and 6) evaluation methods to assess whether learning objectives have been met.

COSEE Pacific Partnerships

Online

Schultz, S. (2010). Oregon Master Naturalist Coast Ecoregion: Sandy Beaches and Dunes. Florence, OR: COSEE Pacific Partnerships, University of Oregon Institute of Marine Biology.

This curriculum unit of the Coastal Master Naturalist Program was developed by a COSEE PP partner scientist with assistance from COSEE PP staff to teach master naturalist volunteers-in-training about the physical and biological parameters of sandy beaches and dunes and human influences on these habitats.

Trowbridge, C. (2010). Oregon Master Naturalist Coast Ecoregion: An Introduction to Coastal Habitats. Charleston, OR: COSEE Pacific Partnerships, University of Oregon Institute of Marine Biology.

This curriculum unit of the Coastal Master Naturalist Program was developed by a COSEE-PP partner scientist with assistance from COSEE PP staff to teach master naturalist volunteers-in-training about the diversity of habitats of the Oregon coast including forest, streams, estuaries, sandy beach, dunes, rocky shores, coastal headlands, shallow subtidal, shelf, deep ocean and sea mounts and covers fundamental ecological processes important in each habitat.

Trowbridge, C. (2009). Rocky Shore Biology of the Pacific Northwest. Astoria, OR: COSEE Pacific Partnerships, University of Oregon Institute of Marine Biology.

This one-day professional development curriculum unit, including field activity, was designed by a COSEE PP partner scientists to teach community college faculty about marine biodiversity, physical factors affecting marine organisms, and zonation patterns on a sand-influenced, rocky intertidal shore.

Other

Carlin Morgan, K., Rowe, S., Hodder, J., Gehrke, C., Johnson, P., Hunter, N., Emanuel, R., & Patterson, B. (2010). Coastal Master Naturalist Program Curriculum Outline. Newport, OR: COSEE Pacific Partnerships.

The curriculum for the Oregon Coastal Master Naturalist Program is the result of a collaboration between COSEE PP staff and scientists, Oregon Sea Grant education and extension specialists, and informal science education and volunteer organizations active on the Oregon Coast.

Rowe, S., Barthel, C., and Schmoock, H. (2009) Communicating Ocean Sciences for Informal Audiences Informal Science Educators Professional Development Curriculum. Newport, OR: COSEE Pacific Partnerships.

This is a five-session curriculum based on COSIA principles and materials with new materials created, piloted and evaluated by COSEE PP staff.

Rowe, S. (2010). Meeting the public at the rocky shore: Promoting lifelong learning about the ocean. Newport, OR: COSEE Pacific Partnerships.

This is a one day professional development curriculum designed to teach volunteer interpreters to use constructivist learning principles, learning cycles, and guided questioning strategies to interpret rocky intertidal areas to public audiences.

Rowe, S. (2010). Better Communication with PowerPoint, Visualizations, and Posters. Newport, OR: COSEE Pacific Partnerships.

This curriculum combines research from cognitive psychology, communications theory, and informal science learning research to offer recommendations to scientists, graduate students, and professional communicators on communicating their work to public audiences.

Trimble, A., & Ruesink, J. (2010). Mariculture in our coastal zones examined through ecological science. Ocean Shores, WA: COSEE Pacific Partnerships, University of Washington.

This is a half-day professional development curriculum designed by COSEE PP partner scientists to provide community college faculty with current information on local and global mariculture growth, introduced (sometimes invasive) species, environmental impacts, husbandry practices, and known ecological interactions, and address how science can provide ecological data to assist management and potentially quantify ecosystem services for informed legislative tradeoffs in our quest for sustainability of these multi-use ecosystems.

Levine, M., Prahl, F., & Dever, E. (2010). Ocean Observing Systems. Newport, OR: COSEE Pacific Partnerships, Oregon State University.

This is a one-day curriculum designed by COSEE PP partner scientists to teach community college faculty about the history of ocean observing systems (OOS), types of OOS, resolving time and space, OOS data, publically available OOS dataset, and using OOS data in the classroom as part of a week-long community college faculty professional development institute.

Hales, B. (2010). Carbon cycling in the Ocean and Global Climate Change. Newport, OR: COSEE Pacific Partnerships, Oregon State University.

This is a one-day curriculum designed by a COSEE PP partner scientist to teach community college faculty about the global carbon cycle, the basics of ocean alkalinity, the carbonate system in seawater, ocean acidification and the impact of increased ocean corrosivity on North American Pacific Oysters as part of a week-long community college faculty professional development institute.

White, A. (2010). Hyperbole and the North Pacific Plastic Patch. Newport, OR: COSEE Pacific Partnerships, Oregon State University.

This is a half-day curriculum, including a field activity, designed by a COSEE PP partner scientist to teach community college faculty about recent research findings regarding plastic pollution in the ocean and on the seafloor and to promote classroom discussion about the representation of science in the media, sources of scientific knowledge and identifying hype, and how would this topic and other popular media subjects be presented in the classroom as part of a week-long community college faculty professional development institute

White, A. (2010). Phosphorus in our waters: from essential nutrients to eutrophication and harmful algal blooms. Newport, OR: COSEE Pacific Partnerships, Oregon State University.

This is a half-day laboratory curriculum designed by a COSEE PP partner scientist to teach community college faculty about phosphorus in the ocean, the problem of nutrient loading and eutrophication, roles of humans in ecosystem interactions, analytical methods, skills associated with field sampling, statistics, and reporting scientific data as part of a week-long community college faculty professional development institute.

Boehlert, G. (2010). Ocean Renewable Energy. Newport, OR: COSEE Pacific Partnerships, Oregon State University.

This is a one-day curriculum, with classroom activity, designed by a COSEE PP leader scientist to teach community college faculty about ocean renewable resources resource availability, technologies for ocean renewable, potential environmental effects of wave energy development, and human dimensions and user conflicts as part of a week-long community college faculty professional development institute.

Apple, J. (2010). Analyses and Meta-analysis of Online Data. Anacortes, WA: COSEE Pacific Partnerships, Western Washington University.

Curriculum developed by a COSEE PP leader scientist to teach community college faculty about the use of online data sets and combining multiple studies to determine a larger, emergent pattern that might not appear in smaller, isolated studies as part of a four-day community college faculty professional development institute.

Apple, J. (2010). Oceanographic cruises. Anacortes, WA: COSEE Pacific Partnerships, Western Washington University.

Field activity curriculum developed by a COSEE PP leader scientist to teach community college faculty about oceanographic cruises and data collection and analysis as part of a four-day community college faculty professional development institute.

Bingham, B. (2010). Coral bleaching and anemones. Anacortes, WA: COSEE Pacific Partnerships, Western Washington University.

Curriculum unit developed by a COSEE PP partner scientist to teach community college faculty about coral bleaching and anemones as part of a four-day community college faculty professional development institute.

Trujillo, A. & Hodder, J. (2010). Teaching pedagogy and techniques, overview of interactive teaching methods. Anacortes, WA. COSEE Pacific Partnerships, University of Oregon.

Curriculum unit developed to teach community college faculty effective teaching methods for oceanography classes as part of multi-day community college faculty professional development institutes.

McDonald, S. (2010). Estuaries and Invasive Species. Anacortes, WA: COSEE Pacific Partnerships, University of Washington.

Curriculum unit, including field activity, developed by a COSEE PP partner scientist to teach community college faculty about invasive species, conducting intertidal surveys in an estuarine environment as part of a four-day community college faculty professional development institute.

Strom, S. (2010). Predator prey interactions and marine food webs. Anacortes, WA: COSEE Pacific Partnerships, Western Washington University.

Curriculum unit developed by a COSEE PP partner scientist to teach community college faculty about predator prey interactions and marine food webs as part of a four-day community college faculty professional development institute.

Newton, J. (2010). Overview of hypoxia in Hood Canal and Coastal Oregon. Anacortes, WA: COSEE Pacific Partnerships, University of Washington.

Curriculum unit developed by a COSEE PP partner scientist to teach community college faculty about hypoxia in the Pacific Northwest as part of a four-day community college faculty professional development institute.

Sprenger, A., & Newton, J. (2010). NANOOS and Using real-time data in classes and lesson plans. Anacortes, WA: COSEE Pacific Partnerships, Northwest Association of Networked Observing Systems.

Curriculum unit developed by a COSEE PP partner scientist and educator to teach community college faculty about ocean observing systems and using real-time data in the classroom as part of a four-day community college faculty professional development institute.

Sutton, A. and Apple, J. (2010). Ocean acidification. Anacortes, WA: COSEE Pacific Partnerships, Western Washington University.

Curriculum, including laboratory activity, developed by a COSEE PP staff scientist and partner scientist to teach community college faculty about ocean acidification as part of a four-day community college faculty professional development institute.

Blake, S. (2010). Climate and Water Resources. Anacortes, WA: COSEE Pacific Partnerships, Washington State University/Washington Sea Grant.

Curriculum developed by a water resource educator to teach community college faculty about climate and water resources as part of a four-day community college faculty professional development institute.

Carlton, J. (2009). Estuaries: The Big Picture and The Role of Invasive Species in Shaping the Biodiversity of Estuaries of the Pacific Northwest. Charleston, OR: COSEE Pacific Partnerships, University of Oregon.

This is a one-day curriculum, with field activity, developed by a COSEE PP partner scientist to teach community college faculty about estuaries, critical habitats, estuarine biodiversity on a salinity-temperature gradient, and the ecology and policy of exotic species invasions in estuaries as part of a week-long community college faculty professional development institute.

Trowbridge, C. (2009). The influence of habitat area and disturbance on biodiversity patterns on rocky intertidal shores. Charleston, OR: COSEE Pacific Partnerships, University of Oregon.

This is a one-day curriculum, including field activity, developed by a COSEE PP partner scientist to teach community college faculty about the influence of habitat area and disturbance on biodiversity patterns on rocky intertidal shores as part of a week-long community college faculty professional development institute.

Shanks, A. (2009). Oceanography and the Open Ocean. Charleston, OR: COSEE Pacific Partnerships, University of Oregon.

This is a half-day curriculum, including laboratory activities, developed by a COSEE PP partner scientist to teach community college faculty about the basics of biological oceanography, the effects of temperature and salinity on water density, how density differences cause the vertical stratification of the ocean, and the processes of Mediterranean outflow and coastal upwelling as part of a week-long community college faculty professional development institute.

Shanks, A. (2009). The Biology of *Cancer magister*, the Dungeness Crab, and How Biology Affects the Fishery. Charleston, OR: COSEE Pacific Partnerships, University of Oregon.

This is a half-day curriculum developed by a COSEE PP partner scientist to teach community college faculty about the natural history of the Dungeness crab fishery and the Dungeness crab fishery as part of a week-long community college faculty professional development institute.

Wimpee, C. (2009). The Lighter Side of Marine Biology: Bioluminescence in the Oceans. Charleston, OR: COSEE Pacific Partnerships, University of Oregon.

This curriculum, including laboratory activity, was developed by a COSEE PP partner scientist to teach community college faculty about bioluminescence, how it likely evolved, bioluminescent organisms, what it is used for, and where it is found as part of a week-long community college faculty professional development institute.

Wimpee, C. (2009). Winogradsky Columns. Charleston, OR: COSEE Pacific Partnerships, University of Oregon.

This curriculum, including laboratory activity, was developed by a COSEE PP partner scientist to introduce community college faculty to the use of Winogradsky columns in the classroom as enrichment cultures and to demonstrate the growth and zonation of microbial communities and covers the basics of energy metabolism as part of a week-long community college faculty professional development institute.

Young, C. (2009). Deep Sea Biology. Charleston, OR: COSEE Pacific Partnerships, University of Oregon.

This is a half-day curriculum developed by a COSEE PP partner scientist to teach community college faculty about fundamentals of deep-sea ecology, deep-sea organisms, environmental issues in the deep sea, and technology and the history of deep sea exploration as part of a week-long community college faculty professional development institute.

Hodder, J. (2009). Island Biology. Charleston, OR: COSEE Pacific Partnerships, University of Oregon.

This is a one-day curriculum developed by a COSEE PP leader scientist to teach community college faculty about the importance of islands to marine birds and mammals and about the biological diversity of seamounts and the impacts of fishing and mining as part of a week-long community college faculty professional development institute.

COSEE Coastal Trends

Murray, L, E. Day-Miller, C. Gurbisz, A. Ward, K. Jensen. 2011. An Introduction to our Dynamic Ocean: An Ocean Science Curriculum
http://www1.coseecoastaltrends.net/ocean_science

COSEE Coastal Trends staff and Land-Sea Scientist-Educator Partners. From the Land to the Sea Module.
http://www1.coseecoastaltrends.net/modules/from_land_to_the_sea/

This educational module was developed summer 2010 in a partnership with COSEE Coastal Trends and the UMCES HPL faculty (Tom Fisher) and graduate students. It focuses on 3 sub-sections: Learn about watersheds, Explore the research associated with watersheds, and Teach the classroom activities developed by the team.

COSEE Coastal Trends staff and Marine Bacteria Scientist-Educator Partners. Marine Bacteria Module, 2009.
http://www1.coseecoastaltrends.net/modules/marine_bacteria/

This educational module was developed summer 2009 in a partnership with COSEE Coastal Trends and the University of Delaware faculty (D. Krichman) and graduate students. *It focuses on 4 sub-sections: Learn about marina bacteria, Explore the trend, Investigate current research, and Access classroom activities.*

COSEE Coastal Trends staff and Fish and Physics Scientist-Educator Partners. Fish and Physics Module.
http://www1.coseecoastaltrends.net/modules/fish_and_physics/

This educational module was developed summer 2009 in a partnership with COSEE Coastal Trends and the UMCES HPL faculty (E. North) and graduate students. *It focuses on 4 sub-sections: Learn about striped bass, Explore the trend of striped bass populations, Investigate current research on the ETM and striped bass life history, and Access classroom activities; an introductory video is on the home page.*

COSEE Coastal Trends staff and Seagrass Scientist-Educator Partners. Seagrass Module.
http://www.coseecoastaltrends.net/modules/seagrass/get_started/

This educational module was developed summer 2008 in a partnership with COSEE Coastal Trends and the Long Term Ecosystem Reserve (*Anheuser-Busch Coastal Research Center), Oyster, VA faculty (K. McGlathery) and graduate students. It focuses on 4 sub-sections: Learn about seagrasses, Explore the trend, Investigate current research, and Access classroom activities; an introductory video on seagrasses is on the home page.*

COSEE Coastal Trends staff and Dead Zone Scientist-Educator Partners. Dead Zone Module. http://www.coseecoastaltrends.net/modules/dead_zone/get_started/

This educational module was developed summer 2008 in a partnership with COSEE Coastal Trends and the UMCES HPL faculty (WM Kemp) and graduate students. It focuses on 4 sub-sections: Learn about dead zones, Explore the trend, Investigate current research, and Access classroom activities; an introductory video on dead zones is on the home page.

Murray, L and D. Gibson, 2007. ***Taking the Pulse of our Ocean. Users Guide for Observing Systems Education*****.**
http://www.coseecoastaltrends.net/ocean_pulse

This curriculum is based on our experience of conducting a workshop for secondary school teachers over four year, and focuses on the science associated with coastal ocean observing systems for educators. The main objective of the program was to bring together scientists and educators to study ocean science through coastal observing systems and the information these systems can provide on physical and biological processes. Teachers adapted activities presented in the workshop to their classrooms.

Murray, L, Boicourt, B., Kelley, ***A. Density: Lessons for High School Science*****. January 2006.**

This CD-ROM describes density currents through two power point presentations and includes a classroom lesson on water density.
http://hpl.umces.edu/faculty/murray/outreachoce.html

COSEE Networked Ocean World

IN PROGRESS

NJ 4-H Climate Change Investigations Leader's Guide. McDonnell, J. Ferraro. C, Lichtenwalner, S. and Rothenburger, L.

Leader's Guide paired with Pasco data probes to increase understanding of climate science through collection of weather, non contact temperature, and carbon dioxide. Kits will be put on loan to all NJ counties for 4-5 weeks of lessons and activities.

COOL Classroom Online Learning Environment: Spatial Literacy. Duncan, R., McDonnell, J., Lathrop, R., Lichtenwalner, S., Ferraro, C.

Spatial Literacy Unit has eight weeks of classroom and computer based instruction (see draft at http://new.coolclassroom.org/adventures/explore/seagrass).

COOL Classroom: Marine Life Migration and Habitat Exploration: An Online Inquiry Unit. Dunbar, L., McDonnell, J., Lichtenwalner, S., Ferraro, C.

Unit has seven weeks of classroom and computer based instruction to teach interpretation of field research data using fish tagging data.

Jersey Roots, Global Reach… 4-H Climate Science/Climate Change Educational Program Jersey Roots, Global Roots CYFAR Steering Committee

Educational activities designed to help youth in high at-risk communities develop a greater understanding of global climate change and its impact on our local communities. The overall objective is to teach students about the science, causes, and impacts of climate change.

Antarctica Melting: A Story in Four Acts. Ferraro, C., McDonnell, J., Lichtenwalner, S. Schofield, O.

Unit has four weeks of classroom and computer based instruction to teach interpretation of field research data using Long Term Ecosystem Research (LTER) data.

Great Explorations in Math and Science (GEMS) Ocean Science Sequence Teachers Guide (2010). Halversen, C. and McDonnell, J.

Part of a two day classroom and laboratory experience at Liberty Science Center (Jersey City, NJ). This lesson introduces school group and public audiences to the variety of ways ocean data is collected and used.

COMPLETED

COOL Classroom Online Learning Environment (2004, revised 2009). McDonnell, J., Simms, E., De Luca, M.

COOL Classroom (www.coolclassroom.org; http://new.coolclassroom.org) is an online learning environment for middle and high school students to experience cutting edge science through scientific inquiry.

The Hudson River Plume Unit is twelve 45-minute sessions of classroom and computer based instruction including 4 hands-on activities, and 4 readings. *See complete unit at http://new.coolclassroom.org/adventures/explore/plume.*

McDonnell, J., Duncan, R., Lichtenwalner, S., Dunbar, L., Fraser, C., Ammerman, J. Taking the Pulse of Our Changing Planet: Coastal Observing Systems as a Key to Teaching Ocean Sciences in Middle Schools (2004, revised 2009). McDonnell, J., Hotaling, L., Newman, M. Edited by Haddock, B.

159-page curriculum unit (http://www.cosee-ma.net/education/curriculum/index.htm) designed to introduce middle and high school teachers and students to using real time oceanographic data in the classroom. The unit has four units:

Unit 1: Ocean Observing Systems illustrates how traditional oceanographic sampling techniques provide scientists "snapshots" of what is taking place in the ocean in contrast with coastal and ocean observing systems which provide a more complete, continuous picture of the physical conditions of the ocean, and the organisms that live in it, over large geographic areas.
Author: McDonnell, J.

Unit 2: Ocean Circulation covers the physical oceanography of ocean currents. By absorbing, storing and releasing the sun's energy through its constant motion, the oceans have influenced our global climate. Observing systems will help us understand how the ocean can influence our weather in the short-term and our global climate in the long-term.
Authors: Hotaling, L and McDonnell, J.

Unit 3: Are You An Ocean Critter? explores how the distribution of marine organisms is based in part on the temperature, salinity and currents in the ocean. Scientists use temperature, salinity and current data from observing systems to better understand and predict the movement and distribution of marine organisms.
Authors: Hotaling, L and McDonnell, J.

Unit 4: Ecosystem Health explores ecosystems' health and how humans cause change in the marine environment in a variety of ways and how scientists use coastal observing systems and real-time data to monitor and predict changes in our coasts' environment.
Authors: Newman, M., McDonnell, J., Hotaling, L.

Teacher Resources and background materials for educators.
Authors: McDonnell, J., Hotaling, L.

Halversen, C. and McDonnell, J., 2009. Great Explorations in Math and Science (GEMS) Ocean Science Sequence Teachers Guide.

For Grades 3-5, Units 1 (104 p), Unit 2 (142 p), and Unit 3 (68 p).

New Jersey Marine Activities Resources & Education (MARE) Golden Lessons (2008). Griffin, M., McDonnell, J, Haskins, S., Lobby, K. Draine, J.

Designed to introduce the Marine Activities Resources & Education (MARE) curriculum to New Jersey schools. It contains three lessons for each of grades K-8 and includes appropriate documentation of how the lessons fit into the New Jersey Core Curriculum Standards.

New Jersey Marine Activities Resources & Education (MARE) Guide to Shallow Bays (2005, revised 2008). McDonnell, J. and Pochaski, T.

Designed to introduce 3rd and 4th grade students to estuaries and shallow water ecosystems as part of the East Coast version of Marine Activities Resources & Education (MARE) program. Edited to meet the New Jersey core curriculum standards.

Water Masses. Gardner, Catherine E.; Florio, Kate B.

Part of a two day classroom and laboratory experience at Liberty Science Center (Jersey City, NJ). In this lesson students explore concepts of water density while collecting and analyzing water quality data.

Ships, Ocean, and Satellites. Gardner, Catherine E.; Lichtenwalner, Sage.

Part of a two day classroom and laboratory experience at Liberty Science Center (Jersey City, NJ). Students explore the spatial and temporal changes of temperature in the surface ocean, and the different ways we sample the ocean to collect data, and the advantages and disadvantages these can have.

Sea 3-D. Gardner, Catherine E.; Florio, Kate B.

Part of a two day classroom and laboratory experience at Liberty Science Center (Jersey City, NJ). Students explore changes in ocean temperature with depth, and are also introduced to temporal variations in this data.

Move It or Lose It – Ocean Migration Game. Gardner, Catherine E.; Busse, Aly; Yehas, Cathy; Florio, Kate B.

Part of a two day classroom and laboratory experience at Liberty Science Center (Jersey City, NJ). Students must use simulated temperature data to make game decisions as a marine creature trying to survive in appropriate water temperatures.

Design an Aquarium. Gardner, Catherine E.; Busse, Aly; Yehas, Cathy; Florio, Kate B.

Part of a two day classroom and laboratory experience at Liberty Science Center (Jersey City, NJ). Students must look at the preferred water quality of different native species to design an aquarium, and then use SST data to plan collection days.

Exploring the Ocean with Robots. Lund, Anthony; Randall-Goodwin, Evan; Florio, Kate B.; Gardner, Catherine E.

This hands-on experiment at Liberty Science Center (Jersey City, NJ) is designed to introduce public audiences to submersible gliders used for scientific research, and how these devices operate to conserve battery power for long mission at sea. Data from current research is shown to illustrate the value of remote sampling in the ocean.

Exploring Ocean Careers. Deidre Sullivan, Tora Johnson

A 30-hour online course, Exploring Ocean Careers[1], that is integrated with the OceanCareers website. This course is being used by dozens of colleges and high schools across the country. This course was largely developed with funds from COSEE California. To view Exploring Ocean Careers go to http://ilearn.mpc.edu/course/view.php?id=5217 Username= mast31guest; Password=ocean

Coral Bleaching: A White Hot Problem. Lawrence, Lisa Ayers.

A collaborative effort posted on both the COSEE NOW website and the Bridge website, students assess coral bleaching using water temperature data from the NOAA National Data Buoy Center. This activity can be used in both classroom and informal settings.

Don't Even Sink About it! Petrone, Christopher J.

This hands-on activity encourages students to work through activities and demonstrations that use online resources and ocean observing systems data to investigate the buoyancy considerations of commercial shipping. This activity can be used in both classroom and informal settings. This activity can be found on both the COSEE NOW and Bridge websites.

Can't Take the Heat? Petrone, Christopher J.

Students use ocean observing system data to investigate why water acts as a thermal buffer and the practical applications this has. This activity can be used in both classroom and informal settings and is posted on both the COSEE NOW and Bridge websites.

[1] To view Exploring Ocean Careers go to http://ilearn.mpc.edu/course/view.php?id=5217 Username= mast31guest; Password=ocean

Development of audio-visual, media and computer materials.

Video

McDonnell, J., Bovitz, L., Lyons, R. (2009). Rutgers University Climate and Environmental Change Teen Summit. Two video products to support the program:

- Climate Change Science. Video to explain the importance of research in climate science.
- Why do you do what you do? Video to explain the Rutgers University faculty involved in climate change research. See http://4hset.rutgers.edu/media/Climate%20Change%20Summit.mov.
- Why scientists do what they do? Video to explain the Rutgers University faculty involved in climate change research.

McDonnell, J. Halversen, C. McKee, M. (2009). A Tour of Ocean Habitats. DVD for the Lawrence Hall of Science/Carolina Biological Curriculum for Grades 3-5 (30 minutes).

Selected Media

Alvarez, A. (April 14, 2010). Getting Under the Ocean Surface. Rutgers Today http://www.youtube.com/watch?v=pYMzXcPQauI.

A short video piece on Ocean Day event combining the undergraduate students from the Communicating Ocean Science for Informal Audiences (COSIA) class and 60 middle school students participating in Marine Activities Resources & Education (MARE) program.

Shapiro, A. (2009-2010). Science Minutes.

A series of short 90 second radio pieces on scientists participating in the Centers for Ocean Science Education Excellence Networked Ocean World (COSEE NOW). Aired on NPR station WCIA Cape Islands MA. http://aridanielshapiro.wordpress.com/science-minutes/ Provided scientist contacts and facilitated interviews.

Podcasts

Shapiro, Ari, McDonnell, J and Yoder, J. (2008-2010).

Ocean Gazing is a bi-weekly podcast series that is designed to highlight scientists involved in ocean observing systems. The podcast is produced by Dr. Aril Daniel Shapiro. J. McDonnell and Dr. Jim Yoder at Woods Hole Oceanographic Institution (WHOI) direct the content, decide the scientists to be interviewed, and approve the scripts for each broadcast.

- **Dotted Shrimp and sugary fish.** This podcast follows the work of Dr. Carla Curan from Savannah State University. November 12, 2010.

- **Imminent Thaw** highlights the work of Phyllis Stabeno, a physical oceanographer at NOAA. November 1, 2010.
- **MBARI a Seaside Sequel.** Cheri Everlove, formerly a mechatronic engineer at the Monterey Bay Aquarium Research Institute, or MBARI, explains how he communicates with a robot in the ocean. October 15, 2010.
- **ROVers over and under** is the first of a two-part visit to the Monterey Bay Aquarium Research Institute, or MBARI focusing on the work of Craig Dawe, the Technical Support Manager, says of Moss Landing, CA. October 2, 2010.
- California's Ocean explores the California coast to find out about the ways in which several very different people are using the state's ocean observing systems. September 3, 2010.
- **A diary of dirt. Un cuento sobre el clima** follows the work of Frank Muller-Karger, an oceanographer at the University of South Florida where he directs the Institute for Marine Remote Sensing. August 20, 2010.
- **Sounds of Science** details life aboard the JOIDES Resolution, the ocean drilling research vessel in the northeast Pacific. August 3, 2010.
- **Scientists, Teachers, and Artists Oh My!** This podcast give us a glimpse of life at sea on the RV JOIDES Resolution vessel. July 23, 2010.
- **Reflections.** This podcast is a reflection of the first 37 podcasts to refocus attention on the accomplishments of the COSEE program. July 9, 2010.
- **A Field of Green.** This podcast focuses on Dr. Margaret McManus and her work in Hawaii understanding phytoplankton populations and the natural system. June 25, 2010.
- **Music from the Bottom of the Food Chain**. This podcast was co-produced by the Encyclopedia of Life highlights the role of phytoplankton in the ocean, June 11, 2010.
- **Accentuate the Positive**. Janice McDonnell highlights the results of Rutgers University Ocean Day, which was a culmination of a year-long program where students learned about ocean science through the Marine Activities Resources & Education (MARE) program. May 28, 2010.
- **One World One Ocean Part II**. This cast focused on high school students and college students talking about their experience with ocean education in China. May 14, 2010.
- **One World One Ocean Part I**. Drs. Chen and Wang, along with numerous Chinese and American students, professors, and government officials, worked to organize the first ever COSEE-China planning workshop. April 30, 2010.
- **A River Runs Through it All.** António Baptista, the director of the Center for Coastal Margin Observation and Prediction; a collection of Oregon-based research institutions, universities, local colleges, and community groups, explains how they are working together to both predict and influence the coastal margin of the Columbia. April 2, 2010.
- **Liquid Light.** Corey Koch, a chemist and post-doc with Wetlabs Inc. explains how a suite of sensors allows scientists to see what's going on in the Oregon Coastal ecosystem. March 19, 2010.
- **A Sixty Ton Wake up Call.** This is from a series called the Podcast of Life produced by the Encyclopedia of Life, which is an online, evolving encyclopedia of every species on the planet. March 5, 2010.
- **Adroitly Adrift.** Kara La Lomia is part of a team at Southern Maine Community College (SMCC) that's designing, constructing and using drifters. These floating instruments track the currents, and are engaging everyone from students to lobstermen. February 19, 2010.

- **Bobbling and Bowling.** Steve Schmidt, a biology teacher at Newman Catholic High School in Wisconsin and coach for the school's Lake Sturgeon Bowl team, participates in the National Ocean Science Bowl, a high school competition about ocean science and stewardship. February 5, 2010.
- **The Antarctic Circumpolar Current, Composed.** Lynn Talley puzzling out the ocean's circulation: basically how all that water gushes and surges and flushes around our planet. January 22, 2010.
- **A Green Ocean.** Gene Feldman uses satellites to monitor and study the oceans. And the work that he and his colleagues are doing has revolutionized our understanding of life on Earth. January 8, 2010.
- **The Little Sub That Could.** This is a short piece on the recovery of Rutgers RU 27 in Spain. It was aired on the program Here and Now hosted by Robin Young. December 25, 2009.
- **Keeping Watch on a Changing Ocean.** Richard Lampitt and Kate Larkin are coordinating a massive European effort to look at, listen to, and touch the global oceans. December 11, 2009.
- **Community Organizing, Ocean Style.** Ocean observatories are radically changing not only the way scientists do their science, but also how they interact with one another and the wider public. It's a vision as large as the Earth itself. November 27, 2009.
- **Ocean Voices.** This episode focuses on Halsey Burgund, a musician and sound artist living just outside of Boston, creating a musical composition involving the oceans. November 13, 2009.
- **The Final Frontier.** The Inner Space Center makes visiting the bottom of the ocean easier than going to the store. And by using some of the newest technology available, it's allowing us to study our most ancient past. October 30, 2009.
- **Clearing a Carbon Catastrophe**. We're letting loose tons — literally — of carbon dioxide into our skies each day. And a good amount of that CO2 is finding its way into the ocean. Scientists from all over the world are rolling up their sleeves to try to avoid a global disaster. October 16, 2009.
- **The Prince's Predictions, Part II.** Predicting how an entire body of water circulates is no easy task. To do it in Prince William Sound up in Alaska, it took 3 ships, teams deployed in the field and in the lab, and a real balance between work and play. October 2, 2009.
- **The Prince's Predictions, Part I.** Twenty years ago, an environmental disaster rocked Prince William Sound in Alaska. Today, a team assembled from science, government and beyond is trying to help make sure it never happens again. September 18, 2009.
- **Antarctica Melting**. Climate change is impacting even one of the most remote places on Earth: Antarctica. Krill numbers are down, salp numbers are way up, and the entire food web down there is in the balance. September 4, 2009.
- **Gliding on Earth.** Rutgers University students are piloting one tiny, yellow, torpedo-shaped glider across the Atlantic Ocean from New Jersey to Spain. The journey is bound to be full of excitement and danger. August 21, 2009.
- **Dungeons and Darwins.** Sometimes understanding the vastness of the ocean means understanding the wee strands of DNA packed into the tiniest of cells, and how that DNA gives those cells some very special abilities. August 8, 2009.

- **Autonomous, Enormous, Ingenious.** Autosubs look like giant yellow torpedoes. They cruise the ocean silently. But they're watching, listening, probing, and measuring everything as they go. July 24, 2009.
- **A Gust of Energy.** A lot of people are talking about capturing the wind's energy. But Jim Miller's pointed his ears underwater, and it turns out that harnessing the wind kicks up a different kind of pollution. July 10, 2009.
- **Penguins in the Hot Seat**. The temperature in Antarctica is rising, and Hugh Ducklow is watching an entire ecosystem change before his eyes. What happens if the ice just keeps on melting? June 26, 2009.
- **Of Bonds and Blooms.** Sometimes the ocean can be a threat to human health. Barb and Gary Kirkpatrick, a wife and husband scientist team, describe what they're doing to notify the Florida public about red tides and harmful algal blooms. June 12, 2009.
- **The Ocean as Classroom**. Janice McDonnell and Jim Yoder describe the urgent need to translate ocean science into formal and informal educational opportunities across the country, engaging scientists, educators and kids everywhere. May 29, 2009.
- **The Glide of a Lifetime: Part II.** Scott Glenn and Oscar Schofield have a passion for creating the next generation of ocean explorers. In this episode, they'll share their deep commitment to education and why they feel it's going to help ocean science in the long run. May 16, 2009.
- **The Glide of a Lifetime: Part I.** Oscar Schofield and Scott Glenn pilot underwater robots all over the world, sampling the ocean half a world away and saving lives in the process, but they never have to leave Rutgers University in New Jersey. May 1, 2009.
- **Top models: Huijie Xue Gazes into the Future of the Gulf of Maine.** Huijie Xue forecasts the underwater weather of the Gulf of Maine: its temperature, its salinity, and its currents. And a lot of people are tuning in. April 17, 2009.
- **Cyber Fiber: John Orcutt and Frank Vernon Wire the Ocean.** John Orcutt and Frank Vernon are wiring the ocean to the Internet. And their goal is to let anyone anywhere tap into the vast data stores. April 3, 2009.
- **Sonar in the Sea: Kelly Benoit-Bird Listens to the Ocean.** Kelly Benoit-Bird works on all kinds of ocean animals ranging from zooplankton to whales. And ocean observatories could make her science even more exciting. March 20, 2009.
- **Coral Concerns: Chris Martens Studies the Reef by Living on It.** Chris Martens is alarmed by the global disappearance of corals. To learn more, he lives at the bottom of the ocean on Conch Reef off Key Largo, Florida for up to 2 weeks at a time. March 6, 2009.
- **Seeing the Small: Heidi Sosik and Rob Olson on their Underwater Camera**. Heidi Sosik and Rob Olson describe how a shared frustration led them to develop a special underwater camera that takes pictures of tiny cells in the ocean. It has revolutionized how the ecology of the ocean is studied. February 20, 2009.
- **An Internet Portal into the Ocean: a Conversation with John Delaney**. Welcome to the first episode of Ocean Gazing, a podcast where we look at, listen to and touch the ocean to unpack its secrets. On this week's program, we'll hear from University of Washington oceanography professor John Delaney. February 6, 2009.

Computer Materials

Flash Computer Interactives: A suite of computer interactives to help illustrate scientific concepts to adult and youth audiences.

- **Eutrophication** (2008). Flash interactive piece designed to illustrate the process of eutrophication at the macro, micro and molecular level. http://coseenow.net/blog/eutrophication-animation/
- **Ocean Literacy Interactive** (2008). Flash interactive piece designed to explain the seven ocean literacy principles. http://coseenow.net/blog/ocean-literacy-interactive-animation/ This interactive has been featured in the National Ocean Literacy Campaign: Scope and Sequence for Grades K-12. National Marine Educators Association (March 2010) Special Report #3. P. 12
- **Food Web Game** (2004, revised 2008). Computer game designed to teach youth marine food web interactions. See http://www.coolclassroom.org/cool_windows/home.html.
- **Discrete Verses Continuous Data.** (2004, revised 2008). Interactive power point and video to explain the differences between continuous and discrete data streams.

Websites

The 4-H Science, Engineering & Technology website (2008 and updated weekly). http://4hset.rutgers.edu

The main SET web presence for New Jersey 4-H. Developed content and supervised web master to create the web presence.

Centers for Ocean Science Education Excellence Networked Ocean World (COSEE NOW) (2007 and updated daily/weekly). www.coseenow.net

An NSF funded social networking site for scientists and educators to collaborate and produce effective products and services to improve ocean literacy in public audiences. First iteration of the website was COSEE Mid Atlantic (2002).

COOL Classroom (2001).
www.coolclassroom.org and http://new.coolclassroom.org

Are interactive learning environments for middle and high school age students to use real time data from ocean observing systems to understand the ocean.

Online blogs and workgroup with COSEE NOW (2009).
http://coseenow.net/groups/

Contribute to posts for various COSEE NOW workgroups.

www.OceanCareers.com (2004)

A one-of-a-kind web site that currently describes, in detail, 60 ocean-related careers seamless integrated with the DOL's Bureau of Labor Statistics databases. This site includes profiles of working professionals, professional societies, marine employers, and more than 1200 U.S. ocean-related education and training programs. This site was developed with funds from COSEE California and is currently maintained and improved with funds from COSEE NOW.